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ABSTRACT

This study investigated educators' use of TENET, a statewide educational telecomputing network in Texas. It also documented the development and testing of a lengthy theory-based questionnaire and verified the efficacy of a method for administering surveys via electronic mail. The 70-item survey was sent to a random sample of 300 TENET users with a response rate of 66%, and was designed to measure variables which have been identified as important to understanding use of computer-mediated communication systems: personal attributes (demographic characteristics and computer experience); environmental characteristics (access, cost, training and time, and social context; perceived media characteristics (ease of use, social presence, utility and relative advantage); patterns of use (amount and type of use); and gratifications obtained (cognitive, diversion, and interpersonal utility). The response rate was 66%. The majority of respondents were highly experienced and educated public school teachers, support staff, and administrators who were experienced computer users with easy access to equipment needed to connect to TENET. Participants logged on to TENET an average of 4-6 times per week. Electronic mail was the most often used network function. Most respondents felt TENET was useful. The network served professional, as well as social and diversionary functions. Social integration with a community of TENET users was a consistent and strong predictor of both usage and satisfaction variables. Ten tables illustrate findings. (Contains 32 references.) (MAS)

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Educators' Use of Electronic Networks: An E-Mail Survey of Account-Holders on a Statewide Telecomputing System

ED 385 229

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Abstract

This study investigated educators' use of TENET, a statewide educational telecomputing network in Texas. It also documented the development and testing of a lengthy theory-based questionnaire and verified the efficacy of a method for administering surveys via electronic mail. The 70-item survey was sent to a random sample of 300 TENET users. The response rate was 66%. The majority of respondents were highly experienced and educated public school teachers, support staff, and administrators, who were experienced computer users with easy access to equipment needed to connect to TENET. Participants logged on to TENET an average of 4-6 times per week. Electronic mail was the most often used network function. Most respondents felt TENET was useful. The network served professional, as well as social and diversionary functions. Social integration with a community of TENET users was a consistent and strong predictor of both usage and satisfaction variables.

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Introduction

In recent years there has been a significant increase in the number of educators with access to educational telecomputing networks, as well as growth in the number and quality of networked educational resources. Recent surveys indicate that between 35-40% of American educators have access to telecomputing facilities from their school buildings, although only 3-5% have access from their own classrooms (National Center for Educational Statistics, 1995; National Institute of Standards and Technology, 1994). More than 40 states now provide public educators with some level of Internet access (Doty, 1995).

Such networks can increase opportunities for interaction and collaboration among, and ultimately development of communities of, K-12 teachers, preservice teachers, teacher educators, content-area experts, and others in professions and agencies serving school populations. In addition, they can help educators stay current with best practices in their field and can help them to overcome problems such as teacher isolation and limited on-site access to information. Telecomputing systems may also be used in education courses as a means of instructional delivery, as a vehicle for interaction among students and instructors, and as a topic of instruction. In addition, they may be used to provide support for field experiences, student teaching, and the induction of first year teachers. Such networks can also be used instructionally in K-12 classrooms in the form of interpersonal exchanges, problem solving projects, and information collection, analysis, and exchange activities (Harris, 1995).

This paper reports a study that investigated how a particular educational telecomputing network was used. The virtual site for the study was the Texas Education Network (TENET), which was authorized and established through Senate Bill 650 of the 71st Texas Legislature (Parker, 1989) and officially opened in August of 1991. More than 33,000 educators (representing approximately 15% of the state's teaching force) registered for TENET accounts during its first 3 years of operation. The network has been expanding rapidly at a rate of about 1,000 new accounts per month. At the time the study was conducted, TENET offered electronic mail, discussion forums or newsgroups, Clarinet's news service, a user directory, reference

databases, interactive access to remote Internet services, access to file archives via FTP, and the ability to locate other Internet resources via Gopher.

Although a considerable amount of descriptive information exists about the kinds of telecomputing activities and projects being conducted by educators, and some small-scale research studies focusing mainly on individual projects have been reported, there has been little broad-scale systematic analysis of educators' use of telecomputing networks (Honey & Henríquez, 1993). Thus far, four survey-based studies of precollege educators' use of telecomputing networks have been reported (Broholm & Aust, 1994; Frazier & Frazier, 1993; Honey & Henríquez, 1993; Mathies & Nelson, 1995).

The rapid growth rates in the availability and use of educational telecomputing systems, and their potential for enhancing educational practices, underscores the immediate need for applicable research results that will help guide efforts to design, implement, and make effective use of such networks. The primary aim of the present study was to investigate educators' use of a statewide educational telecomputing network. Specifically, the following research questions were asked:

1. What are the characteristics of network users, the contexts in which they use the network, and their perceptions of it?
2. How much is the network used overall and how often are different types of network services used?
3. What are the outcomes of network use?
4. What factors are related to network use and to outcomes of such use?

The current study differs from previous studies in that it is a large-scale survey of a randomly selected sample of users of a single educational telecomputing network. Although many claims have been made regarding the benefits of such networks, and substantial resources have been devoted to their development and implementation, there has been little empirical evidence to support these claims or to justify the allocation of resources to such endeavors. Information gleaned from the present study can help justify and guide the development and implementation of

educational telecomputing networks, as well as provide a basis for improving methods of helping educators acclimate to and apply online resources to serve their needs and meet their goals.

This study also tested a method for administering surveys electronically in an educational context. As the use of telecomputing systems continues to grow, so does the applicability of electronic mail surveys. Thus, it is important to determine whether this method, which had been used previously in the study of a public telecomputing system (Anderson, 1992; Anderson & Gansneder, 1995), can be effectively applied in educational settings.

Unlike previous research on use of educational telecomputing, the survey instrument utilized was based upon theories developed by communication researchers. The questionnaire which was developed and tested in this study measured a wide range of variables identified as important, according to several theoretical perspectives, to understanding use of computer-mediated communication systems. The selection of variables to be measured was based primarily upon a model for studying personal computing developed by Dutton, Kovaric, and Steinfield (1985) which, in turn, was based upon the theories of Diffusion of Innovations (Rogers, 1983) and Uses and Gratifications (Katz, Blumler, & Gurevitch, 1974). The availability of a reliable and valid instrument based upon theory and broadly applicable to the use of computer-mediated communication systems in educational settings can help to build a base of generalizable research and can allow researchers to test the applicability of communication theories in the context of educational telecomputing systems.

Method

Sample

Sampling procedure. Surveys were sent via electronic mail to a random sample of 300 TENET account holders who had used the system at least once during a 2-week period immediately prior to the survey mailing. In addition, these individuals had previously agreed to participate in research on TENET. During the fall of 1993, as part of the process of updating information in TENET's user directory, individuals were asked about whether they would be willing to participate in research regarding TENET. The system operator provided a list of 8,382

users who had responded affirmatively to that question, as well as a list of 7,620 users who had logged onto TENET during a 2-week period in mid-June. The sampling frame consisted of 3,839 users who appeared on both lists, from which a random sample of 300 user IDs was then drawn.

Response rate. A total of 190 surveys were returned within 4 months of the initial mailing. Data provided by the system operator indicated that 12 of the 300 who were sent surveys did not log on during the survey period. Thus, the response rate based upon the 288 users who actually received the survey was 66%. Excluding undeliverable surveys and/or ineligible respondents from consideration in calculating response rates is common practice with conventional interviews and mailed surveys (Babbie, 1990; Dillman, 1978). According to Dillman, this procedure provides a more direct indicator of a method's response-inducing capabilities than do other methods.

Response bias. To investigate the potential for response bias, we compared the frequency of log-ons by respondents and nonrespondents. These data were generated from log files kept on the TENET computers over the 4-month survey period. This comparison revealed that respondents were likely to use the system more often ($t = -4.21$, $p < .001$) and for more time ($t = -3.22$, $p < .001$) than were nonrespondents. On the average, respondents logged in more than twice as often and for more than twice as much time than did nonrespondents.

Procedure

Initial mailing. Procedures for administering the survey were adapted from Dillman's (1978) Total Design Method for mailed surveys and had been used in a previous survey of users of a community telecomputing system (Anderson, 1992; Anderson & Gansneder, 1995). A cover letter and 70-item survey were sent to sample members via electronic mail. The cover letter introduced the questionnaire and attempted to motivate individuals to respond. Each person's first name was typed into the greeting of the cover letter, which was sent in a separate message immediately preceding the survey. Respondents could respond via e-mail, print out the survey and return it via regular postal mail, or request a paper-based survey and return it in the self-addressed stamped return envelope supplied. The initial mailing yielded a return rate of about 25%.

Follow-ups. Up to three follow-up messages were sent to nonrespondents at 2, 4, and 8 weeks from the initial mailing date. As with the initial mailing, the follow-up messages were sent individually and each person's first name was typed into the greeting of the message. Each follow-up message served as a reminder and used a slightly different approach and successively stronger appeals for the return of the survey. These follow-up messages yielded returns of 16%, 18%, and 7%, respectively.

Privacy safeguards. A primary ethical issue related to collecting data via computer is that of privacy. Thus, precautions were taken to ensure that participation in this study would not harm participants in any way. In accordance with standard procedures for the protection of human subjects, informed consent was obtained from participants and confidentiality was provided by removing the identifying information on each survey returned electronically and then replacing it with a random identification number.

Data coding. One of the advantages of electronically administered questionnaires is that they allow at least some, if not all, of the data coding to be automated. Surveys in which respondents edited in their responses could usually be coded by computer, whereas others had to be coded by hand in the usual manner. Computer-coded data was checked carefully and errors were corrected by hand. Answers to open-ended questions and comments inserted by respondents within or at the end of the survey instrument were either transcribed (for those received via postal mail) or cut and pasted (for those received via electronic mail) into a word processed document in tabular format. This allowed us to categorize and sort data for the purpose of content-analyzing answers to open-ended questions and written survey comments.

Instrument

The 70-item questionnaire was designed to measure variables which have been identified as important, according to several theoretical perspectives, to understanding use of computer-mediated communication systems (Dutton, et al., 1985; Katz, et al., 1974; Rogers, 1983). Five categories of variables were measured by the survey: personal attributes, environmental

characteristics, perceived media characteristics, patterns of use, and gratifications obtained (see Table 1).

Table 1

Variables Measured by the Survey

Category	Variables
Personal Attributes	Age, Gender, Education, Teaching Experience, Job Type, Workplace Location, Computer Experience
Environmental Characteristics	Computer Access, Training and Support, Time Pressure Social Integration, Contacts Reached Via TENET
Perceived Media Characteristics	Ease of Use, Social Presence, Utility, Relative Advantage
Patterns of Use	Time Online, Frequency of: Logging-on, Reading/Sending Private/Public Messages, Accessing Online Resources
Gratifications Obtained	Cognitive, Interpersonal, Diversion, Student-Oriented

Whenever possible, survey questions were based upon reliable and valid measures that had been used in previous studies. In many cases, a variable was measured by several related items which could then be combined to form a scale. Reliability coefficients (Chronbach's alpha) for these scales ranged from .64 to .92. Many items were derived from two prior surveys of a community telecomputing system conducted by Swift (1989) and Anderson (1992). Other items were based on those used in research conducted by Culnan (1984), Garramone, Harris and Anderson (1986), Hiltz and Johnson (1989), Marshall (1987, 1990), Rafaeli, (1986), and Steinfield (1986). In addition, items from other surveys of educational telecomputing systems (Frazier & Frazier, 1993; Honey & Henríquez, 1993) were included to allow comparisons between the current results and those reported previously.

Results

Personal Attributes

Demographic characteristics. TENET users tended be seasoned educators who worked in public school systems and had completed advanced levels of schooling. Seventy-seven percent of the respondents worked in public school systems. The majority (66%) had 10 or more years of experience working as educators. Teaching tenure ranged from 0 to 44 years, with an average of 15 years. Thirty-five percent of the sample were classroom teachers, 16% served in support roles such as that of library media specialist or computer coordinator, and 24% were school or district-level administrators, regional service center staff, or state education agency personnel. More than half (60%) had completed one or more graduate-level degrees.

Respondents ranged in age from 20 to 70, with a mean age of 44. Slightly more than half were female (53%). The sample was geographically diverse; 42% worked in an urban setting, 33% worked in a suburban community, and 26% worked in a rural area. Respondents were scattered among nearly 100 different Texas towns and cities, with clusters of 10 or more located in several of the larger cities (Austin, Houston, and San Antonio).

Computer experience. Respondents had a great deal of experience with using computers. Eighty-seven percent had 5 or more years of experience with computers, with 36% having over 10 years of computer experience. Slightly less than half (44%) had been using TENET for over 2 years. Thirty-seven percent had never used another telecomputing network. Of those who had used other networks, about half (54%) had been using them for more than 2 years.

Environmental Characteristics

Access. The majority of respondents reported easy access to TENET. Most reported that the equipment they ordinarily used to connect to the system was close by (92%), accessible (94%), and convenient (92%). More than half (57%) usually accessed TENET from home. Of those who typically used TENET at work, 88% had access from their own classroom or office. The majority (86%) reported having relatively few difficulties connecting to the system. Most (87%) dialed into

TENET via modem (61% dialed a local number and 26% dialed a toll-free number) whereas a small minority (11%) typically accessed TENET via a direct network connection.

Cost. Another aspect of access is affordability. Although it was not directly addressed by the survey, cost and/or source of funding emerged as issues of concern to some survey respondents. Twelve respondents chose to address this topic when asked for general comments at the end of the survey. Some expressed frustration about the expense of providing connectivity within school buildings to allow more widespread access to TENET. Half of those who addressed cost in their comments expressed their approval of what was perceived to be a very low price ($5 per year for public school personnel and $25 per year for others) for the amount of interpersonal and informational resources available via TENET. A few compared TENET to commercially available online services, apparently agreeing that it is less costly, but at the expense of being less user-friendly and/or technically sophisticated.

Training and time. About half of the respondents (51%) had learned to use TENET without assistance, whereas the rest had learned with the help of a friend or colleague (23%) or by attending inservices, conference workshops, or college courses (24%). Thirty-eight percent had no ongoing source of continuing assistance for their use of TENET. Others had help available through other teachers or school staff (19%) or from district-level computer coordinators, TENET trainers, regional service center staff, or university faculty (29%). All of the comments that addressed assistance for using TENET mentioned the need for help with technical, rather than curricular or communications challenges. Several stated a preference for individualized interpersonal assistance rather than consulting a printed manual or calling TENET's "help desk." Other comments linked assistance with time pressure. Given the busy schedules of typical teachers and administrators, it is not surprising that most respondents reported experiencing pressures in their environment at least occasionally; 93% said their lives sometimes or frequently involved time pressures, 87% reported the occurrence of unexpected problems or situations, and 78% reported experiencing urgent matters or crises. Comments suggested that such pressures, especially with

regard to time, may limit the extent to which users explore various features of the system, especially those that are somewhat complex.

Social context. Another relevant aspect of users' environment is "social integration" or the extent to which individuals participate in a social network of other users (Burt, 1973; McQuarrie, 1989). Most respondents (88%) were not the only person using telecomputing at their work site. Of those, about half (51%) collaborated with others on telecomputing activities or served as a resource person for others. In addition, 11% of the sample held leadership positions on TENET by serving as a trainer or newsgroup moderator. Most (80%) thought of themselves as members of a community of TENET users even when they were not using the system. Many engaged in interactions with others concerning past (64%) or future (60%) TENET sessions or exchanged tips with others about what to do or how to do something on TENET (74%).

On the average, respondents regularly communicated with at least one or two other people they knew via TENET. Many (64%) kept in touch with 3 or more co-workers or colleagues (including those who were friends), whereas about a quarter (23%) usually corresponded with 3 or more personal or social contacts (who were not also co-workers or colleagues). About half (47%) consistently contacted more than 2 people outside their school district but within Texas, whereas only 22% regularly reached more than 2 out-of-state contacts.

Perceived Characteristics of TENET

Ease of use. On the average, respondents perceived TENET as being relatively user-friendly: 66% considered it understandable, 56% felt it was simple, and 58% rated it as relatively easy to use. Comments regarding TENET's ease of use were mixed, with some indicating a high degree of satisfaction with the user interface and others complaining about its complexity.

Social presence. Responses were less positive regarding the system's "social presence," or the degree to which users perceived co-communicators to be socially and psychologically present (Short, Williams, & Christie, 1976). Half of the sample indicated that they thought the system was sociable, whereas less than half found it to be sensitive (43%) or personal (41%).

Utility. Nearly all the respondents (96%) felt that TENET was useful. Many (56%) found it to be useful in many ways and 24% felt that it had "revolutionized their work or communication processes." The majority also rated TENET as effective (78%) or efficient (73%).

Relative advantage. This media characteristic refers to the degree to which TENET was perceived as being better than other ways of communicating or accessing information (Rogers, 1983). Respondents generally found TENET to be advantageous, compared to other media, for accessing information and communicating with others. Most (87%) agreed that without TENET, it would more difficult to obtain information and that they often looked for information on TENET that they would not otherwise have sought. The majority also said that without TENET it would be more difficult to reach people they wanted to contact (81%) and that they often communicated with people whom they would not otherwise have contacted (82%).

Patterns of Use

Amount of use. On the average, respondents reported logging onto TENET 4-6 times per week for 15-30 minutes per session and for a total of about 1-3 hours per week (see Table 2).

Table 2

Amount of Time Spent Online Over 2-Week Period

Amount	n	Percent
Less than 1 hour	55	29%
1-3 hours	68	36
4-6 hours	26	14
7-9 hours	17	9
More than 9 hours	22	12

Note. N=190.

To determine which factors best predicted amount of use, we conducted a stepwise multiple regression procedure. Since those who had to access TENET by a toll-free number were limited to using it for a total of 45 minutes per day, this variable was entered into the equation first to take this restriction into account in the remaining analyses. Next a stepwise regression procedure was used to determine which other variables best predicted amount of use.

In total, 28.2% of the variance in amount of use could be explained by the resulting regression equation (see Table 3). The best predictor of amount of use was the number of contacts users could reach via the network. Social integration was the next best predictor of usage.

Table 3

Prediction of Amount of Use

Variable	R	R^2	R^2 ch	Beta[a]
Part 1:				
Local connection				
vs. toll-free number	.059	.003	.003	-.026
Part 2:				
Interpersonal contacts	.435	.189	.185***	.297***
Social integration	.489	.239	.050**	.188*
Self-taught vs. training	.511	.262	.022*	-.166*
Utility	.531	.282	.020*	.162*
			F(Eqn) = 12.078***	

Note. N = 160.

[a]Standardized regression coefficients are presented because variable scale ranges differed.

*** $p < .001$. ** $p < .01$. * $p < .05$.

The more contacts that participants could reach via the network and the more that they were integrated with a community of TENET users, the more they used the network. Assistance with learning to use the network and perceived utility also contributed to the prediction of amount of use. Those who had taught themselves to use TENET tended to use it more. Finally, the more useful the network was perceived to be, the more it was used. Restrictions due to use of a toll-free number did not significantly contribute to the prediction of amount of use.

Type of use. The most popular use of TENET was reading electronic mail: 77% reported almost always or frequently reading electronic mail messages, whereas somewhat fewer (60%) reported sending messages (see Table 4). Less than half (46%) said they often read newsgroup messages. However, only a very small percentage (3%) reported frequently posting newsgroup messages. Nearly a third (30%) frequently connected to other Internet services via Telnet, while 24% frequently used Gopher to access Internet resources. Special information databases, such as Grollier's Encyclopedia and the AskEric service were used frequently by 16% of the respondents, while TENET's user directory was used frequently by only 9% of the respondents.

Table 4

Usage Patterns for E-mail, Bulletin Boards, Internet Resources, and Databases

	E-Mail		Newsgroup		Internet		Databases	
	Read	Write	Read	Write	Telnet	Gopher	User	Reference
Almost always	59%	35%	28%	1%	8%	8%	0%	3%
Frequently	18	25	18	2	22	16	9	13
Sometimes	15	23	32	11	33	25	34	34
Seldom to never	9	17	24	86	37	52	57	50
N	(188)	(184)	(187)	(181)	(187)	(186)	(186)	(187)

To determine which factors best predicted the extent to which respondents used a variety of different kinds of services available on TENET, we again conducted a multiple regression procedure, using the same method as that used to predict amount of use. In total, 49.7% of the variance in variety of uses could be explained by the resulting regression equation (see Table 5). Social integration was the best predictor of diversity of uses. Another socially-oriented variable, interpersonal contacts, was also a good predictor of usage diversity. The more that individuals were integrated into a community of other network users and the more contacts they could reach via the network, the more they regularly used a variety of network services. The second best predictor of usage diversity was cognitive gratifications, which involved the extent to which users were able to access information and participate in discussions or information exchanges. Receiving this type of benefit was positively related to diversity in the types of services used.

Other predictors of usage diversity included ongoing assistance, ease of use, and telecomputing experience. All of these relate to users' ability to understand how to use different types of network facilities. Those who had a source of continuing assistance for using TENET, those who considered the system to be easy to use, and those who had more telecomputing experience, tended to use a wider variety of different kinds of network services. Easy access to equipment needed to connect to TENET was also positively related to variety of uses.

Interpersonal gratifications seemed to act as a suppressor variable. Although its zero-order correlation with the criterion variable was positive ($r = .16$) its Beta weight in the regression equation was negative. This suggests that its function in the equation was to partial out some of the variance in other variables that was irrelevant to the prediction of the criterion variable. Finally, restrictions due to use of the toll-free number did not significantly contribute to the prediction of variety of uses.

Gratifications Obtained

Prior Uses and Gratifications research has shown that gratifications obtained from media use often factor into three categories: cognitive, diversion, and interpersonal utility (Blumler,

Table 5

Prediction of Variety of Types of Use

Variable	R	R^2	R^2 ch	Beta[a]
Part 1:				
Local connection				
vs. toll-free number	.057	.003	.003	-.037
Part 2:				
Social integration	.505	.255	.252***	.249***
Interpersonal contacts	.568	.323	.068***	.199**
Ease of use	.612	.374	.051***	.186**
Cognitive gratifications	.637	.406	.032**	.248***
Equipment access	.657	.432	.025**	.170**
Ongoing assistance	.673	.453	.022*	.187**
Telecomputing experience	.692	.479	.025**	.173**
Interpersonal gratifications	.705	.497	.019*	-.153*
			F(Eqn) = 16.476***	

Note. N = 160.

[a]Standardized regression coefficients are presented because variable scale ranges differed.

*** $p < .001$. ** $p < .01$. * $p < .05$.

1979; Palmgreen, Wenner, & Rayburn, 1980). In addition to investigating the extent to which TENET users received gratifications in those categories, a fourth category of gratifications was created and assessed in order to examine student-oriented benefits obtained from using TENET. Table 6 shows descriptive statistics for each of the items measuring gratifications obtained.

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Table 6

Descriptive Statistics for Gratifications Obtained

Variable	Mean	SD	N	% responding in top 2 categories
Cognitive				
Access materials, news & information	4.14	.91	189	79%
Find out about events & activities	3.91	1.04	188	76
Participate in educational discussions	3.89	.97	190	63
Exchange ideas, info & advice	3.83	1.13	189	65
Interpersonal				
Keep in touch with people	4.06	1.14	188	75
Plan / schedule work-related meetings	3.22	1.26	187	41
Plan / schedule social activities	2.49	1.17	189	18
Diversion				
Engage in entertaining activities	3.71	1.13	187	59
Take a break from work	3.58	1.32	185	58
Fill up free time	2.81	1.42	187	34
Student-Oriented				
Exchange student info / reports	3.36	1.16	185	44
Access resources for research	3.29	1.27	184	42
Exchange messages outside school	3.18	1.28	185	37
Participate in on-line projects	2.91	1.18	187	26
Practice writing in authentic context	2.89	1.14	182	24

Note. Response categories ranged from 1=strongly disagree to 5=strongly agree.

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To determine which factors best predicted each type of gratification, we conducted a series of two-part stepwise multiple regression procedures. Since, according to the model for studying personal computing developed by Dutton, et al. (1985), amount and different types of use are thought to influence outcomes directly, these variables were allowed to enter into the equation first in a stepwise manner. After that, personal attributes, environment characteristics, and two of the four perceived media characteristics measured were allowed to enter the equation in a stepwise fashion in order to determine which of these other factors contributed to the prediction of gratifications after usage factors had been taken into account. Two media characteristics, relative advantage and utility, were excluded because of their conceptual similarity to the criterion variables. Their relatively high correlations with cognitive gratifications (r = .46 for utility and .57 for relative advantage) and with each other (r = .50) suggested that they may be somewhat redundant measures of very similar constructs. A similar decision was made by Hiltz (1988) who excluded "performance" as a potential predictor of "productivity" in a multiple regression analysis due to evidence that the two were redundant measures.

Cognitive gratifications. The most strongly supported gratifications obtained from using TENET were cognitive in nature. The majority of the respondents agreed that TENET had helped them to "access curriculum materials, content-area information, or news about current events" (79%) and to "find out about state, district, or local happenings or staff development activities" (76%). Many also agreed that TENET had enabled them to "participate in discussions on educational issues, problems, or other current topics" (63%) and to "exchange teaching ideas, information, or advice" (65%).

Stepwise multiple regression was used to determine the best predictors of cognitive gratifications. Almost 45% of the variance in cognitive gratifications could be explained (see Table 7). Usage variables were allowed to enter the regression equation first. Reading newsgroup messages and sending e-mail were positively related to cognitive gratifications, with the former being the best predictor of such gratifications. This suggests that newsgroup messages are a good source of information and that sending e-mail is a good way to request and exchange information.

Table 7

Prediction of Cognitive Gratifications

Variable	R	R^2	R^2 ch	Beta[a]
Part 1:				
Read newsgroup msgs.	.463	.214	.214***	.303***
Send e-mail msgs.	.525	.275	.061***	.161*
Part 2:				
Social presence	.605	.366	.090***	.288***
Social integration	.642	.413	.047***	.229**
TENET experience	.659	.434	.022**	-.167**
Trainer or moderator	.673	.452	.018*	.139*
			F(Eqn) = 21.480***	

Note. N = 163.

[a]Standardized regression coefficients are presented because variable scale ranges differed.

*** $p < .001$. ** $p < .01$. * $p < .05$.

Two socially-oriented variables were the next best predictors of cognitive outcomes--social presence and social integration. The more that users perceived those they communicated with online as being socially and psychologically near and the more they were integrated with a community of TENET users, the more that they obtained cognitive benefits from the network. Another predictor of cognitive gratifications was serving as a TENET trainer or newsgroup moderator. Information exchange is obviously inherent in these roles. Finally, amount of experience with TENET may have acted as a suppressor variable which partialed out some of the variance in other factors that was irrelevant to the prediction of cognitive gratifications. Its zero-order correlation with cognitive gratifications was negligible and not statistically significant.

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Interpersonal gratifications. Support for social or interpersonal gratifications resulting from TENET use was more mixed than that for cognitively-oriented satisfactions. While 75% felt that TENET had helped them "keep in touch with family, friends, and/or colleagues," less than half found it helpful for planning or scheduling work-related meetings (41%) or social activities (18%).

Stepwise multiple regression was used to determine the best predictors of interpersonal gratifications. About 24% of the variance in interpersonal gratifications could be explained (see Table 8). Usage variables were allowed to enter the regression equation first. Writing e-mail messages was positively associated with interpersonal gratifications. It makes sense that e-mail would be used to keep in touch with people and to schedule meetings and social activities. Session duration was negatively associated with interpersonal gratifications. Those who received more interpersonal gratifications tended to have shorter TENET sessions. However, session duration may have been a suppressor variable instead, as its zero-order correlation ($r = -.07$) with interpersonal gratifications was small and not statistically significant.

The best predictors of interpersonal gratifications were interpersonal contacts and social integration. As could be expected, the more contacts reached via TENET and the more that individuals were socially integrated into a community of TENET users, the more that they received interpersonal satisfactions from using the system. Also, those who received assistance when learning to use TENET tended to receive greater interpersonal satisfactions. This could be due to the presence of a friend or colleague who helped them learn to use the network and then became an online communication partner. Alternatively, respondents may have kept in contact with others who were part of a group that received training together.

Diversion gratifications. Support for diversion or entertainment-oriented gratifications was also mixed. Many of the respondents indicated that TENET allowed them to "participate in entertaining conversations or activities" (59%) and that it "provided a nice break from work" (58%). On the other hand, only 34% felt that TENET provided a "means of filling up free time."

Table 8

Prediction of Interpersonal Gratifications

Variable	R	R^2	R^2 ch	Beta[a]
Part 1:				
Send e-mail msgs.	.340	.116	.116***	.168*
Session duration	.376	.140	.025*	-.202**
Part 2:				
Social integration	.438	.191	.051**	.208**
Interpersonal contacts	.468	.219	.028*	.220**
Self-taught vs. training	.489	.239	.020*	.143*
			F(Eqn) = 9.868***	

Note. N = 163.

[a]Standardized regression coefficients are presented because variable scale ranges differed.

*** $p < .001$. ** $p < .01$. * $p < .05$.

Only 14.7% of the variance in diversion gratifications could be explained by a multiple regression equation (see Table 9). The only usage variable that entered the equation, when allowed to enter first, was log-on frequency. However, after the other variables were entered, it did not make a significant contribution to the prediction of diversion gratifications. The best predictor of diversion gratifications was age, which was negatively associated with diversion satisfactions. Younger respondents were more likely to find using TENET to be entertaining or a good way to pass time. After that, social presence and social integration were the next best predictors of diversion satisfactions. The more that users perceived those they communicated with online as being socially and psychologically near and the more they were integrated with a community of TENET users, the more they obtained diversion satisfactions from the network.

Table 9

Prediction of Diversion Gratifications

Variable	R	R^2	R^2 ch	Beta[a]
Part 1:				
Log-on frequency	.188	.035	.035*	.052
Part 2:				
Social presence	.286	.082	.046**	.198**
Age	.345	.119	.037**	-.207**
Social integration	.383	.147	.028*	.192*
			F(Eqn) = 6.720***	

Note. N = 160.

[a]Standardized regression coefficients are presented because variable scale ranges differed.

*** $p < .001$. ** $p < .01$. * $p < .05$.

Student-oriented gratifications. Benefits obtained from student-oriented uses of the network were the least strongly supported: 44% of the respondents indicated that TENET had helped them "send or receive reports or student information," 42% agreed that TENET provided students with "access to resources for research projects," and 37% said that it "enabled students to exchange messages with people beyond school boundaries." Even fewer indicated that the network had allowed their students to "participate in online classroom exchange projects" (26%) or to "practice writing skills in an authentic context" (24%). At the time of the survey, students were only allowed to access the network indirectly via their teacher, as accounts designated for student use were unavailable. Survey comments indicated considerable concern about lack of sufficient student access to TENET for use in instructional activities.

Only 14.2% of the variance in student-oriented gratifications could be explained by a multiple regression equation (see Table 10). The best predictor of student-oriented gratifications was sending e-mail messages, which was positively associated with obtaining student-related benefits. The use of reference databases, the other usage variable which entered the equation in the first block, was also positively associated with student-oriented benefits. Teachers who used TENET for instructional purposes apparently made frequent use of these two types of network facilities. The only other variable to enter the regression equation was social presence, which was positively associated with using the network for instructional activities.

Table 10

Prediction of Student-Oriented Gratifications

Variable	R	R^2	R^2 ch	Beta[a]
Part 1:				
Send e-mail msgs.	.288	.083	.083***	.224**
Use reference databases	.336	.113	.030*	.168*
Part 2:				
Social Presence	.377	.142	.029*	.174*
			F(Eqn) = 8.629***	

Note. N = 160.

[a]Standardized regression coefficients are presented because variable scale ranges differed.

*** $p < .001$. ** $p < .01$. * $p < .05$.

Discussion

The results of this study provide information about the characteristics of TENET users, the contexts in which they used the network, and their perceptions of it, as well as patterns of network

use, outcomes of such use, and factors associated with those usage patterns and outcomes. The questionnaire developed and tested in this study measured a wide range of variables thought to be important to understanding use of computer-mediated communication systems according to several theoretical perspectives. Reliability coefficients (from .64 to .92) for scales combining several items were above generally accepted minimum standards of reliability (.50) for data used to make decisions about groups (Worthen, Borg, & White, 1993). This broadly applicable, field-tested instrument can serve as the basis for further generalizable, theory-based research on the use of educational telecomputing systems.

The methodology used in this study was shown to be an effective and efficient way of collecting data from a random sample of network users via electronic mail surveys. The response rate of 66% for the current survey is typically considered good for mailed surveys (Babbie, 1990) and falls within the range (from 50% to 93%) usually attained by surveys employing the Total Design Method (Dillman, 1978). It is similar to the response rate of 68% obtained in a previous study that employed the same methodology to survey users of a public telecomputing system (Anderson, 1992; Anderson & Gansneder, 1995). For ethical reasons, one of the criteria for inclusion in the sample was a previous affirmative answer to a question regarding willingness to participate in research on TENET. Thus, it is possible that the response rate obtained in this study was somewhat higher that it would have been if that criterion had not been used.

This study is the only survey to date of precollege educators' use of telecomputing networks in which survey recipients were randomly sampled. This allowed us to estimate the ways in which our results may differ from "true" population values. The sample represented individuals who used TENET during the summer and who had held a network account for nearly one year or longer. Investigation of possible response biases indicated that respondents tended to log-on more frequently and for more time than did nonrespondents. Thus, the sample appeared to under-represent infrequent users. This suggests that the range of responses for usage variables was probably restricted and thus the relationships observed between use and other variables may be lower than they might have been otherwise.

Survey respondents can probably be categorized as "innovators" or "early adopters" of educational telecomputing systems, according to Diffusion of Innovations theory (Rogers, 1983). At the time the survey was conducted, approximately 15% of Texas teachers had registered for TENET accounts. Innovators and early adopters typically make up 16% of the members of a social system (Rogers, 1983). Having a high level of education has been a consistent predictor of adoption and use of new communication technologies (Rogers, 1986). Respondents to the current survey were, for the most part, highly experienced and educated public school teachers, support staff, and administrators. They tended to be experienced computer users with relatively easy access to equipment needed to use TENET, often from a home computer and modem. This suggests that they were not only early adopters of computers, but also were probably fairly skilled in using them.

To insure equity, it is important to find ways to involve less experienced and innovative individuals in using telecomputing networks. Concern about the availability and cost of better network connectivity within schools was identified as a predominate theme in the content analysis of survey comments. Providing for adequate network connectivity from school classrooms and offices is one way to enable those without home access to participate in the network. The need for time and assistance (preferably from informal interpersonal sources) for learning to use the network was also mentioned by a number of respondents in their comments. Indeed, about half of the respondents had taught themselves to use the system and nearly 40% reported no ongoing source of assistance for using TENET. Greater availability of training, ongoing assistance, and time would be helpful, if not necessary, for encouraging and enabling less innovative individuals to use the network.

Social and psychological proximity to and contact with other network users seems to be an important condition for regular network use. The majority of respondents worked with others who also used TENET and reported talking with others about past or future TENET sessions or exchanging tips with others. Nearly two-thirds kept in touch with three or more co-workers or colleagues (including those who were friends). Between 40-50% rated the system high in social

presence, indicating that they perceived co-communicators to be socially and psychologically near. These socially-oriented factors appeared repeatedly in regression equations predicting usage and gratification variables. Social integration, or the extent to which users communicated with others about TENET and felt that they were part of a community of TENET users, was a consistent and strong predictor of both usage and satisfaction variables, appearing in all but one (student-oriented benefits) of the regression equations that were formed. The number of contacts reached via TENET was a strong predictor of both amount and diversity of network use, as well as of interpersonal gratifications. Social presence was a good predictor of cognitive and diversion satisfactions.

These findings highlight the social nature of computer-mediated communication systems. According to Diffusion of Innovations theory, social integration plays an important role in the adoption of innovations (Burt, 1973; McQuarrie, 1989; Rogers, 1983). Social networks of individuals who are involved with an innovation provide a mechanism through which information about the innovation is transmitted. This information can influence adoption decisions as well as shape the way the innovation is used after it is adopted. This suggests that interaction with other users may not only encourage network use, but may also help users obtain more benefits from using it. Thus, encouraging such interpersonal interactions may be an useful strategy to facilitate effective network use. Ways for doing this might include conducting group training sessions for intact groups (e.g., teachers at the same school building, committee members, etc.), assigning peer mentors to new users, or providing online user directories and discussion forums that help users with similar interests to locate one another.

Survey respondents were generally active TENET users. On the average, they used the network 4-6 times per week, with nearly one-third logging on once or more each day. Predictors of amount of use included interpersonal contacts, social integration, and perceived utility, all of which were positively related to amount of TENET use. Another predictor was whether participants had received training in how to use TENET. Those who were self taught used the

network more. It seems unlikely that training discourages network use, but that instead, those who taught themselves to use the network may be more motivated or enthusiastic about using it.

Electronic mail was the most often used network function. Respondents read electronic mail more often than they sent it. Sending electronic mail predicted and was positively associated with cognitive, interpersonal, and student-oriented benefits of network use. After electronic mail, reading newsgroup messages was the third most popular network activity. It was also the best predictor of cognitive gratifications. Accessing Internet resources via Telnet or Gopher were the next most frequent network activities, followed by use of reference databases, which was related to student-oriented benefits. Regular use of a variety of network facilities was best predicted by social integration, cognitive gratifications, and interpersonal contacts. Several factors related to individuals' ability to understand and use network facilities also contributed to the prediction of diversity of uses. These included availability of ongoing assistance for network use, perceived ease of use, amount of telecomputing experience, and ease of access to equipment.

TENET clearly provides benefits to educators who actively use the system. Respondents felt overwhelmingly that TENET had been useful to them. Most felt that it had provided them with opportunities to access information and communicate with people that would otherwise be unlikely to occur. Outcomes from using the network were mainly centered around accessing information, exchanging ideas, and discussing issues. Such outcomes closely match one of the aims of the network: to facilitate learning and communication among Texas educators. However, users reported experiencing other types of outcomes, suggesting that for some, network use has become a more integral part of their daily lives. Like the use of other types of media, TENET use resulted in not only cognitive gratifications, but also social and diversion satisfactions. Many respondents reported outcomes of an interpersonal or social nature. Indeed, 75% indicated that TENET was useful for keeping in touch with family, friends and/or colleagues. Many respondents also indicated that TENET served a diversionary purpose. Nearly 60% reported engaging in entertaining conversations or activities and indicated that using TENET provided a nice break from

work. The younger the respondent, the more likely that such gratifications occurred as a result of using the network.

Student-oriented benefits were not as frequently reported as other types of outcomes. Many of the survey comments indicated that improved access for students was desired. Nevertheless, about 40% of the participants seemed to have found ways to use the network for activities that benefitted their students. In addition to access issues, it is likely that involving students in telecomputing activities is a more complex endeavor, and thus it is more difficult to implement than professionally-oriented activities. Educators may need not only improved access for their students, but also improved assistance for using networks in instructional ways.

In order to corroborate the results of the current study and to determine the generalizability of the findings, similar research needs to be replicated on other systems. Studies that build upon the theories generated by communication researchers, or those that attempt to develop new theories, would be particularly helpful in furthering our understanding of educators' network use. In addition, research that purposefully includes infrequent users and/or non-users as well as frequent, active users is needed to identify factors which differentiate these groups and ultimately to help develop methods for encouraging less innovative individuals to adopt and make effective use of educational telecomputing networks. Finally, it is important to remember that telecomputing networks and their users are constantly evolving and growing as the technology changes and as less innovative adopters begin to use it. Those who adopt such networks later will most likely differ from the early adopters represented in the current study. Thus, ongoing research is needed to further our understanding of network use over time. Such knowledge will help to guide the development and implementation of educational telecomputing networks, as well as provide a basis for improving strategies for helping educators learn to use and effectively apply online resources for professional and instructional purposes.

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